

TAXONOMIC STUDIES ON THE *DISINAE*: 2. A REVISION OF THE GENUS *SCHIZODIUM* LINDL.

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ABSTRACT

The genus *Schizodium* is revised. Six species and two subspecies are recognized. Notes on the taxonomically important morphological characters are given. The available information on the ecology and distribution of the taxa is discussed.

UITTREKSEL

TAKSONOMIESE ONDERSOEK VAN DIE *DISINAE*: 2. 'N HERSIENING VAN DIE GENUS *SCHIZODIUM* LINDL.

Die genus *Schizodium* word hersien. Ses spesies en twee sub-spesies word erken. Aantekeninge oor die taksonomies belangrike morfologiese karakters word gegee. Die beskikbare informasie oor die uitbreiding en ekologie van die taksa word bespreek.

INTRODUCTION

Schizodium, a genus of six species, is one of the more peculiar members of the subtribe *Disinae*. This report is part of a general taxonomic study of the whole subtribe.

This genus is one of the first Cape genera to be comprehensively known: by 1838 all the species had been described. Two species were described by Linnaeus (1760), and one by Thunberg (1794). Lindley (1838) described the remaining three species. Lindley also circumscribed the genus as it is understood today.

Subsequent to 1838 several more species were proposed. Bolus transferred the genus to *Disa* in 1888. The genus was revised by Kraenzlin (1900), Schlechter (1901) and Rolfe (1913). Kraenzlin and Rolfe essentially followed Lindley's treatment. Rolfe, by applying the "Kew Rule" even perpetuated Lindley's nomenclatural errors. Schlechter radically redefined the specific boundaries in the genus, to form groups approximating those proposed in the present work. This similarity in treatments is obscured by Schlechter's misapplication of the

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name *S. bifidum* (Thunb.) Reichb. f. to *S. obliquum* Lindl., and by his dividing *S. longipetalum* Lindl. into *S. antenniferum* Schltr., based on a single collection, and the rest of *S. longipetalum*, which he included in *S. bifidum*. The nomenclatural errors of the Schlechter and Rolfe treatments, plus the uncritical treatment by Rolfe (who recognized eight species), resulted in some confusion.

NOTES ON MORPHOLOGY

Vegetative morphology

The distribution and structure of the leaves are uniform throughout the genus. The basal leaf margins are crisped in *S. longipetalum* and sometimes in *S. inflexum* and *S. bifidum*. In general the leaves are concolorous green on the upper surface, but often they are purple below. Towards the eastern part of the distribution range of *S. inflexum* two parallel lines of purple spots frequently appear on the upper surface.

In all species except *S. flexuosum*, *S. bifidum* and *S. inflexum* the stems are strongly flexuose, with at least two 90° angles at right angles to one another. In the three exceptions the angles are often less than 45° and may even be completely absent.

Sepals

The sepals are subequal. Three general shapes are found: in *S. flexuosum* the lateral sepals are broadly obovate. In *S. bifidum*, *S. inflexum* and *S. obliquum* the lateral sepals are narrowly lanceolate, acute and spreading. The other extreme is found in *S. cornutum* and *S. longipetalum*, in which the sepals are narrowly lanceolate and acuminate, and frequently recurved. The most extreme expression of this is found in Schlechter 5248.

Spur

Spur characters have great taxonomic value, but are often difficult to interpret on dried material. In *S. obliquum* the spur is dorsoventrally constricted, and in *S. inflexum* it is widened at the base. The other taxa occupy intermediate positions. Spur length is too variable to provide a good character. The direction of the curvature of the spur can provide valuable information, but exceptions occur.

Petals

The petals consist of a narrowly oblong to lorate limb, which is geniculately upcurved, a basal anticous process and a bifid apex. The limb varies among the species, but the other two characters are valuable. The basal anticous process may be absent (*S. flexuosum*, *S. longipetalum*), developed as a fold (*S. bifidum*, *S. inflexum*), or as a lobe (*S. obliquum*, *S. cornutum*). The bifid apex can be

suppressed, or be equally bifid, or the anterior tooth can be greatly elongate as a filiform tooth (*S. longipetalum*).

Lip

The lip is the most distinctive organ in the genus, and is elaborated into three parts:

1. An apical tooth, which is subulate in all the taxa except *S. flexuosum*, where it is wedge-shaped. Vogel (1959) refers to this as the epichile. Even though the length of the tooth can be variable in some populations, it shows a strong correlation with the specific groupings, being relatively short in *S. obliquum*, intermediate in the *S. longipetalum*.
2. The central horizontal portion (mesochile) is not very variable. In *S. flexuosum* it is yellow with almost black spots, while in the other taxa it is more or less pale pink with parallel lines of dark purple spots. The margin may be plane or undulate.
3. The basal erect concave part (hypochile) of the lip hardly varies among the taxa.

Gynostegium

This structure is remarkably uniform within the genus. The anther is borne horizontally. The rostellum is vertical, and in most species the lateral lobes are well developed and horn-shaped, bearing the viscidia, while the central lobe is reduced to a small fleshy blob between the lateral lobes. In *S. longipetalum* the central lobe is developed as a small flap which lies on the anther. The stigma is shortly pedicellate, the stigmatic surface horizontal, almost oblong, with two well developed cushions and one small cushion.

TAXONOMY

Schizodium Lindl.

Leaves in a flat basal rosette; stem wiry, generally flexuose, less than 400 mm tall; petals erect, bifid apically, lip pandurate, apical part tooth-like, pendant; middle part flat; basal part erect, concave, closing the entrance to the spur; flowers white to pink, in one species yellow.

Plants herbaceous; tubers testicular to globular, c. 10 mm in diameter; stem annual, 60–400 mm tall, wiry flexuous, pale green to purple. *Leaves* basal and cauline; basal leaves in a flat rosette, 3–10, petiolate, spatulate to lorate, apiculate, margins flat or undulate, up to 25 mm long; cauline leaves 1–4, lanceolate, obtuse to acuminate, the apical part usually free.

Inflorescence 1–8 flowered, lax; bracts similar to the cauline leaves; pedicels often distinct from the ovary, included in or exerted from the bracts. *Dorsal sepal* superior, narrowly lanceolate to broadly obovate, obtuse to acuminate, usually galeate; spur 2–12 mm long, acute to bifid, straight or decurved or up-curved, horizontal at the base; linear or clavate, often dorsoventrally constricted at the base. *Lateral sepals* narrowly lanceolate to broadly obovate, obtuse to acuminate, 5–18 mm long. *Petals* free, vertical, usually narrowly oblong, zygomorphic with a posterior knee-bend, apex equally or unequally bifid, sometimes with the anterior tooth long and subulate, basal anticus lobe usually present. *Lip* pandurate; apical tooth wedge-shaped or subulate, 2–16 mm long, pendant or reflexed; mesochile flat, horizontal, broad, the margins occasionally undulate; hypochile vertical, concave, pale, closing the entrance to spur. *Column* short; anther horizontal; rostellum lateral lobes well developed, erect, the apices enclosing the globular viscidia; stigma horizontal, three-cushioned, shortly stipitate.

NOMENCLATURE AND TYPIFICATION

Schizodium Lindl. in Gen. Sp. Orch.: 358 (1838); Harv. in Gen. Pl. ed. 2: 366 (1868); Benth. & Hook. f. in Gen. Pl. 3: 631 (1831); Pfitzer in Nat. Pfl. Fam. 2. 6: 97 (1889); Dur. & Schinz in Consp. Fl. Afr. 5: 113 (1892); Kraenzl. in Orch. Gen. Sp. 1: 723 (1900); Schltr. in Bot. Jahrb. 31: 299 (1901); Rolfe in Fl. Cap. 5. 3: 253 (1913). Schltr. in Die Orchideen: 275 (1915); Senghas in Schltr., Die Orchideen; 275 (1974); Dyer in Gen. S. Afr. Fl. Pl. 2: 993 (1976). *Disa* Bolus in J. Linn. Soc. 25: 196 (1889).

Type: *Schizodium flexuosum* (L.) Lindl., basionym: *Orchis flexuosa* L.

ETYMOLOGY

Probably from the Greek: Schizein = split, eidos = similarity to; referring to the bifid petals (Schultes & Pease, 1963).

KEY TO THE SPECIES OF *SCHIZODIUM*

1. Sepals ovate; dorsal sepal convex, not galeate: 1. **flexuosum**
 1. Sepals lanceolate to linear; dorsal sepal concave, galeate
 2. Sepals obtuse to acute, not reflexed or recurved
 3. Anticus process of the petal a large lobe, often with a serrate upper margin; spur dorsoventrally constricted at the base
 4. Lateral sepals usually longer than 8,5 mm; from the Cape Peninsula, Cape Hangklip, and the flats from the Peninsula to Darling: 4a. **obliquum** ssp. **obliquum**
 - 4'. Lateral sepals usually shorter than 8,5 mm; not from the above areas: 4b. **obliquum** ssp. **clavigerum**

- 3'. Anticous process a small fold; base of the spur widened
 - 5. Dorsal sepal 3–6 mm wide; spur generally slender and curved upwards: 2. **bifidum**
 - 5'. Dorsal sepal 2–3.5 mm wide; spur thick and generally straight or curved downwards: 3. **inflexum**
- 2'. Sepals acuminate, reflexed or recurved
 - 6. Anticous lobe small; petal without a long filiform tooth: 5. **cornutum**
 - 6'. Anticous process absent; petal with a filiform tooth at least as long as the petal: 6. **longipetalum**

1. *Schizodium flexuosum* (L.) Lindl.

Sepals obovate; dorsal sepal erect, concave, reflexed; spur decurved, bifid; flowers brightly white and yellow coloured.

Plants erect, flexuose, 150–350 mm tall, stem pale green to purple, nitid. *Leaves* basal and cauline; basal leaves petiolate, oblanceolate to spatulate, 10–20 mm long and 5–9 mm wide, petiole linear, often sheathing the stem, 5–15 mm long; cauline leaves 2–6, oblanceolate, acute to obtuse, 10–20 mm long, the upper $\frac{2}{3}$ free and recurved from the scape. *Inflorescence* (1)–3–(5) flowered; bracts like cauline leaves; pedicels 5–8 mm long, not exerted from the bracts, ovaries 5–10 mm long; flowers with white sepals and yellow petals and lip, the latter with black spots. *Dorsal sepal* obovate to broadly obovate, 7–10 mm long and 5–10 mm wide, concave, erect with the margins reflexed; spur 2–4 mm long, sharply bent downwards, apex bifid. *Lateral sepals* obovate to broadly obovate, 7–11 mm long and 4–9 mm wide. *Petals* 3–5 mm long, anticous lobe absent, apex bifid, the front tooth as long as the limb, narrowly linear, rarely subulate, the rear tooth very reduced or absent, not included in the galea. *Lip* tripartite; apical tooth wedge-shaped, acute, the margin strongly undulate, 2–4 mm long; mesochile 3–7 mm wide, the margins strongly undulate; hypochile small, concave. *Column* short, anther reflexed, rostellum erect, minute.

NOMENCLATURE AND TYPIFICATION

Schizodium flexuosum (L.) Lindl. in Gen. Sp. Orch.: 359 (1838); Kraenzl. in Orch. Gen. Sp. 1: 726 (1900); Rolfe in Fl. Cap. 5. 3: 254 (1913).

Orchis flexuosa L. in Pl. Rar. Afr.: 26 (1760). Type: *Oldenland* in Herb. Burman (G!, holotype).

Satyrium flexuosum (L.) Thunb. in Prod. Pl. Cap.: 5 (1794).

Disa flexuosa (L.) Sw. in Kongl. Vet. Acad. Handl.: 212 (1800); H. Bol. in Trans. phil. Soc. S. Afr. 3: 160 (1888).

Icones: H. Bolus, Icones Orch. Austro-Afr. 2: t.92 (1911). Schelpe, An introduction to the South African orchids, Pl. 52 (1966). Mason, Western Cape Sandveld Flowers, Pl. 37.3 (1972).

The first collections of this species were apparently made by Oldenland, who was a gardener at the Cape between about 1695 and 1699, when he died. He sent dried material to several people, including Petiver in England. Eventually part of his herbarium fell into the hands of the Burman family (Karsten, 1951). N. L. Burman took this collection to Carl von Linné in the summer of 1760, when the eminent botanist described *Orchis flexuosa* from an Oldenland collection. The Burman herbarium is now in Geneva where the type of *O. flexuosa* still is.

On the type sheet are several annotations, including one indicating that Oldenland was the collector of the specimen, and one referring to Ray's monumental *Historia Plantarum* Tome 3 page 586. Here Ray described an *Orchis Africana*, *nudi hominis effigiem referens*, collected by Oldenland, in Museum Petiver 281. A short description follows, which contains no elements contradicting the description of *S. flexuosum*. It is therefore possible, but by no means certain, that this citation does refer to *S. flexuosum*.

Linnaeus the Younger described *Orchis flexuosus* (1781) from a Sparrman collection: this is a mixed collection of *S. flexuosum* and *S. obliquum* ssp. *obliquum*. Lamarck (1796) also refers to *S. flexuosum*, but under the name of *Orchis undulata*.

DISTRIBUTION AND ECOLOGY

This species falls into the Western Group as defined by Weimarck (1941), with a distribution area extending from Nieuwoudtville to the Caledon Swartberg (Fig. 2). There is also an outlier population at Darling. In view of this, its absence from the Piketberg is remarkable.

It is usually associated with an ericoid—restioid dominated vegetation on alluvial sand derived from Table Mountain Sandstone along streams and in moist spring conditions. A few populations have also been found on shallower soils, but not on mountain slopes. With a few exceptions, all localities are below 1 000 m, and range to near sea-level.

Almost all the precipitation in the area is restricted to the winter months, and ranges from about 500 mm p.a. to about 1 000 mm p.a. (W.B. 29). In some localities snow occurs occasionally in winter.

This species is commonly known as "Salt and Pepper" or "Bacon and Eggs".

REPRESENTATIVE COLLECTIONS

Paarl, in sandy depressions near Paarl, *MacOwan & Bolus* 172 (BM, G, GRA, K, P, UPS, ZT); Vanrhynsdorp, Gift Berg, Sept., *Phillips* 7561 (BOL, K, PRE, SAM, STE); Malmesbury, between Malmesbury and Groenekloof, in damp sand, Oct., *Bolus* 4332 (BM, BOL, K, Z).

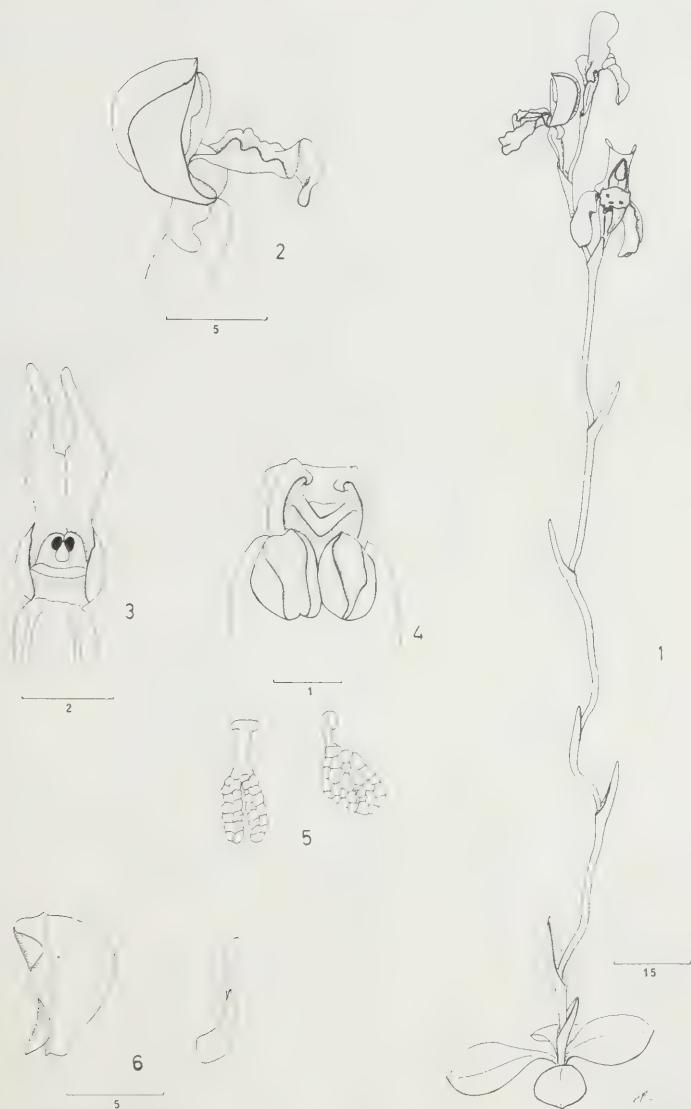
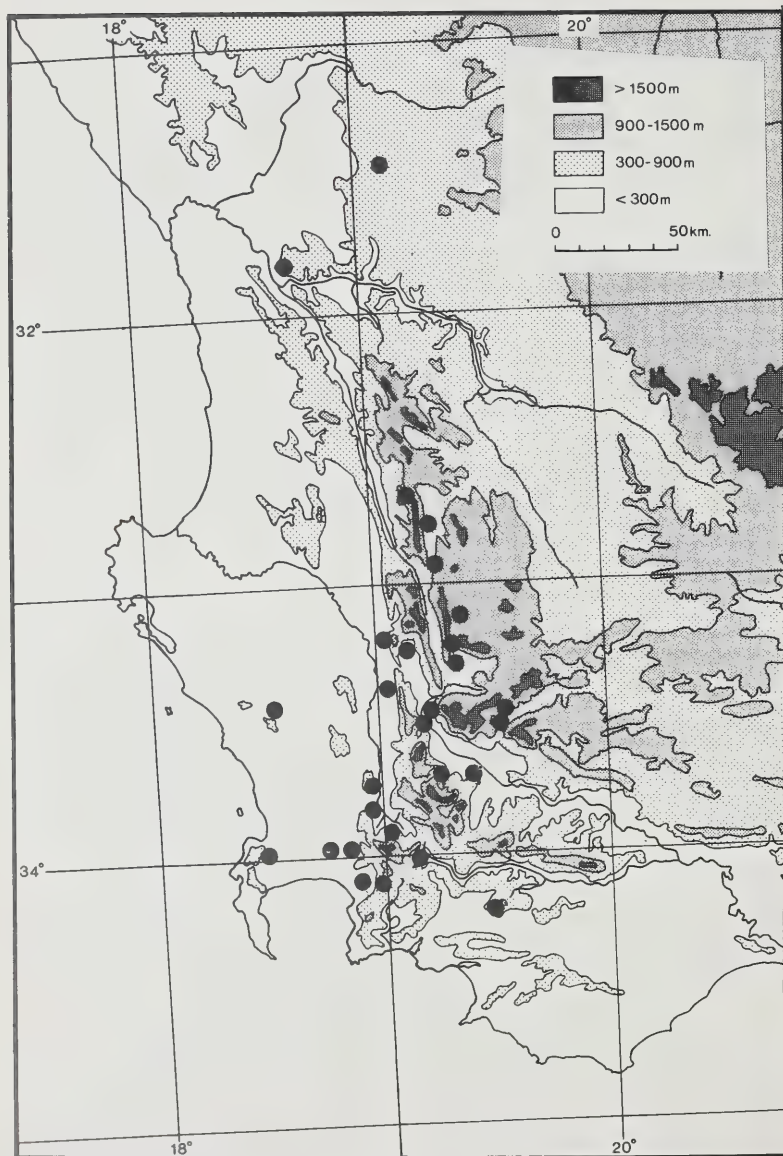


FIG. 1.

S. flexuosum (from Linder). 1. Whole plant, 2. Flower without lateral sepals, 3. Front view of petals and column, 4. Rear view of rostellum, 5. Pollinaria, 6. Sepal and petal in 3 dimensions.



G.P.-S. (L).

FIG. 2.
Distribution map of *S. flexuosum*.

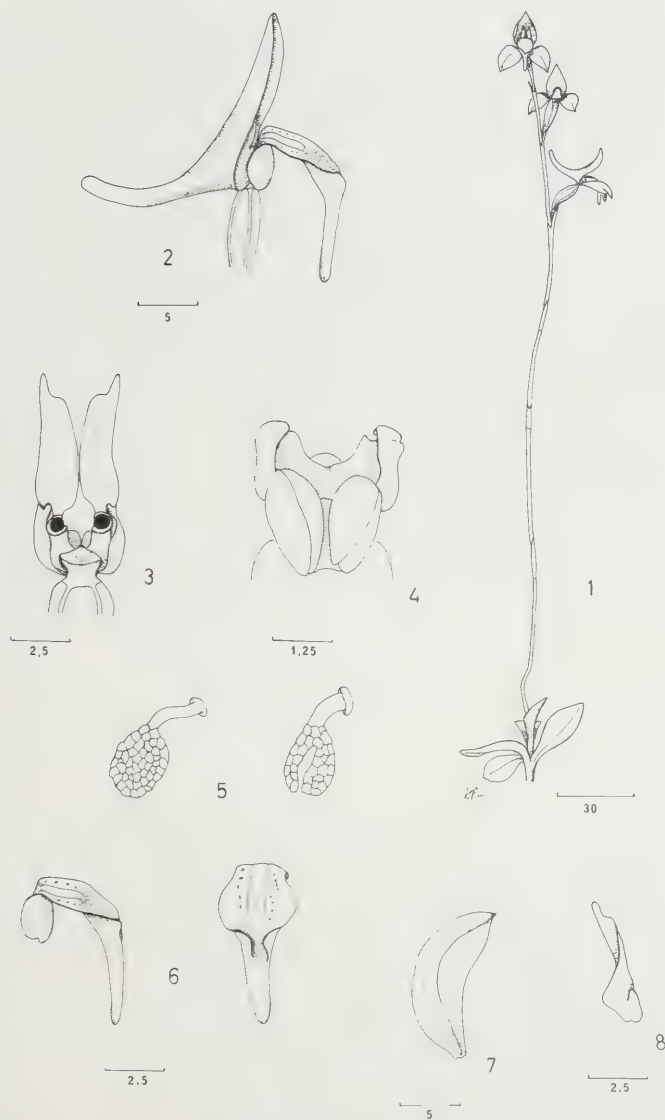


FIG. 3.

S. bifidum (from Linder). 1. Whole plant. 2. Flower with lateral sepals removed. 3. Front view, showing petals and column. 4. Rear view of the rostellum. 5. Pollinaria. 6. Lip. 3-dimensional views, 7. Lateral sepal, 8. Petal.

2. *Schizodium bifidum* (Thunb.) Reichb. f.

Petals with a basal anticous fold; lateral sepals 9–17 mm long and 2.5–4.2 mm wide; spur base in line with the base of the dorsal sepal, generally curved up and narrowed to a point.

Plants straight or sub-flexuose, stem wiry, nitid. *Leaves* basal and cauline; basal leaves spreading, petiolate, the blade narrowly obovate, apiculate, 10–20 mm long and 5–10 mm wide, the margins often undulate, the upper surface occasionally with purple spots; cauline leaves distant, lax, lanceolate, acute to acuminate, 1–5, 6–16 mm long. *Inflorescence* 1–7 flowered; bracts similar to the cauline leaves; pedicels 2–11 mm long, rarely exserted from the bracts, ovaries 3–11 mm long; flowers more or less pink, sepals with small purple freckles on the backs along the midvein, lip tooth greenish to purple, mesochile of the lip with purple spots on the upper surface, apex of the petals often darker. *Dorsal sepal* erect, shallowly galeate, narrowly obovate to narrowly oblong, acute, rarely obtuse, 10–15 mm long and 3–6 mm wide; spur usually upcurved, rarely straight, tapering towards the apex, (7.5)–10–13 mm long and 1–2 mm in diameter. *Lateral sepals* narrowly oblong, sub-oblique, acute, spreading, 10–14 mm long and 2.5–5 mm wide. *Petals* lorate, zygomorphic, 7–8 mm long, basal anticous lobe reduced to a fold, apex usually unequally bifid, acute. *Lip* 10–17 mm long, apical tooth pendant, filiform, 4–8 mm long, mesochile flat, 3–4 mm wide. *Column* short, rostellum lateral lobes horn-like, central lobe reduced to a small fleshy blob.

NOMENCLATURE AND TYPIFICATION

Schizodium bifidum (Thunb.) Reichb. f. in *Flora* 66: 460 (1883); Dur. & Schinz in *Consp. Fl. Afr.* 5: 113 (1892); Kraenzl. in *Orch. Gen. Sp.* 1: 729 (1900); Schltr. in *Bot. Jahrb.* 31: 302 (1901), excl. var. and syn. *S. obtusatum* Lindl. and *S. longipetalum* Lindl.

Satyrium bifidum Thunb. in *Prod. Fl. Cap.*: 5 (1794). Type: Herb. Thunberg 21430 (UPS!, holotype).

Disa bifida (Thunb.) Sw. in *Kongl. Vet. Acad. Handl.*: 212 (1800); Thunb. in *Fl. Cap.*: 58 (1807); H. Bol. in *Trans. S. Afr. phil. Soc.* 5: 163 (1888), *J. Linn. Soc.* 25: 201 (1889).

Schizodium rigidum Lindl. in *Gen. Sp. Orch.*: 360 (1838). Type: Swellendam, Buffelsjag River, Hills at Sparbos. *Drège 1231e* (K!, holotype); Schltr. in *Bot. Jahrb.* 31: 303 (1901); Rolfe in *Fl. Cap.* 5. 3: 255 (1913).

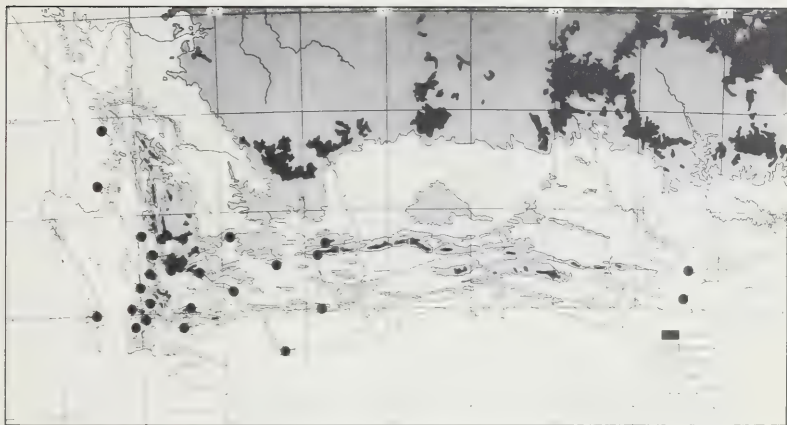


FIG. 4.
Distribution of *S. bifidum*.

Icon: H. Bolus, *Icones Orch. Austro-Afr.* 2: tt 94, 95 (1911).

This species has caused little confusion. Lindley was probably not aware of the nature of the Thunberg's *Disa bifida*, and it was left to Reichenbach to recognize its affinities when he had the opportunity in 1865 to study Thunberg's herbarium. Rolfe (1913) upheld the name *S. rigidum* in preference to the older *S. bifidum* because of the "Kew Rule" then applied by English botanists.

Schlechter (1901) appears to have misapplied the concept of *S. bifidum*, as the synonyms that he cites under this name are allied to the *S. obliquum* group, and he maintains *S. rigidum* as a distinct entity.

TAXONOMY, ECOLOGY AND DISTRIBUTION

Schizodium bifidum is closely allied to *S. inflexum*. The vast majority of collections can readily be distinguished by the larger flowers, the broader dorsal sepal, and the slender, tapering, ascending spur of *S. bifidum*. However, several populations in the Ceres and Bainskloof areas appear to be somewhat intermediate. As these populations occur in the ecological overlap zone of the two species, they could well be the results of ancient hybridization.

S. bifidum occurs throughout the fynbos region, except for a large gap between the Gouritz River and Port Elizabeth (Fig. 4). Populations are almost always restricted to fairly flat areas of deep sand. The species also tends to occur at relatively low altitudes, except at the inland localities. Recorded precipitation over the distribution area ranges from about 500 mm p.a. to over 1 000 mm p.a. Rainfall distribution also ranges from a clear winter-rainfall regime in the west,

to a spring maximum rainfall (but with precipitation throughout the year) in Port Elizabeth.

Flowering in this species occurs in September and October, with occasional specimens in flower collected as early as July. Flowering time is closely linked to altitude, and populations from the Worcester and Ceres mountains flower last.

REPRESENTATIVE COLLECTIONS

Ceres, Skurfteberg Pass into the Agterwitsenberg Valley, Sept., *Linder* 575 (BOL); Ladismith, south slopes of the Swartberg below Toverkop, c. 1 000 m, Aug., *Esterhuysen* 333896 (BOL); Somerset West, moist sand near Sir Lowry's Pass, 150 m, July, *Schlechter* 1175 (BOL).

3. *Schizodium inflexum* Lindl.

Petals without a basal anticous lobe; sepals 7–12 mm long and 2–3.5 mm wide; spur base in line with the base of the dorsal sepal, generally straight or curved down, base usually swollen.

Plants straight or subflexuose, 80–350 mm tall, wiry, nitid, pale green to purple. *Leaves* basal and cauline, basal leaves spreading, petiolate, the blade oblanceolate to narrowly oblanceolate, apiculate, 10–20 mm long and 5–9 mm wide, the margins occasionally undulate, the blade often with two lines of dark spots on the upper surface and purple below; cauline leaves more or less closely sheathing the stem, distant, acute to acuminate, 6–16 mm long. *Inflorescence* 1–7 flowered; bracts similar to the cauline leaves; pedicel rarely exserted from the bracts, 2–7 mm long, ovary 3–10 mm long; flowers pink, sepals with darker spots on the back along the midrib, tooth of lip usually dark purple, mesochile of lip with darker spots along the margin, petal apex darker. *Dorsal sepal* erect, galeate, obtuse to acute, narrowly oblong, 6–8 mm long and 2–4 mm wide; spur more or less straight, rarely somewhat upcurved or decurved, upper and lower margins usually parallel, apically rounded or emarginate, the base often widened, 5–8 mm long and 2–4 mm deep. *Lateral sepals* narrowly oblong, obtuse to acute, sub-oblique, spreading, 7.5–10–(12) mm long and 2–3–(4) mm wide. *Petals* lorate, zygomorphic, apically acute, truncate or shallowly bifid, 5–7 mm long, basal anticous lobe reduced to a fold. *Lip* 9–13–(16) mm long, apical tooth pendant, filiform, 3–7 mm long, mesochile margins flat or undulate, 3–5 mm wide. *Column* short, rostellum lateral lobes horn-like, central lobe very reduced.

NOMENCLATURE AND TYPIFICATION

Schizodium inflexum Lindl. in Gen. Sp. Orch.: 360 (1838). Type: Cape Province, *Burchell* (K!, holotype); Dur. & Schinz in Consp. Fl. Afr. 5: 113 (1892); Kraenzl. in Orch. Gen. Sp. 1: 727 (1900); Schltr. in Bot. Jahrb. 31: 304 (1901); Rolfe in Fl. Cap. 5.3.: 254 (1913).

Disa inflexa Mund. Lindl. in Gen. Sp. Orch.: 360 (1838), nom. nud.; Bolus in Trans. S. Afr. phil. Soc. 5: 162 (1888), J. Linn. Soc. 25: 201 (1889).

Icons: H. Bolus, Icones Orch. Austro-Afr. 2:t. 93 (1911). Kidd, Wild Flowers of the Cape Peninsula, Pl. 94.7 (1950). Schelpe, An introduction to the South African orchids, Pl. 53 (1966).

TAXONOMY, ECOLOGY AND DISTRIBUTION

The relationship to *S. bifidum* is discussed above.

S. inflexum can, by its distribution, be described as being ubiquitous in the Cape Flora (Weimarck, 1941). It occurs along the fold mountains from Nieuwoudtville to Humansdorp, and inland it extends to the Witteberg and the Elandsberg. It has been collected on every major mountain range in the Cape Floral Area.

It is essentially a mountain species, with no collections from below 300 m, and the majority of collections are from between 900 and 1 200 m. It is usually associated with shallow soils overlying Table Mountain Sandstone bedrock, or with areas which are very rocky. In this habitat it occurs both in well-drained habitats, or in slight seepages, often associated with *Restio curviramis* (especially in the Cedarberg and the Bokkeveld mountains).

The climate in this habitat is severe, with snow in the winter months. No reliable rainfall data are available for most of the localities, but it is probably in excess of 1 000 mm p.a.

Flowering occurs mainly in October and November, but occasional collections have been made in September (especially at the western end of the distribution), and in December and even January. Vogel (1959) discussed the possible pollination mechanism of this species, and concluded that it is best adapted for pollination by hymenopterans. This work has not been substantiated by field observations.

REPRESENTATIVE COLLECTIONS

Uniondale, Joubertina, north slope of the Tsitsikamma mountains, in a swamp, Nov., *Esterhuysen 10633* (BOL); Ceres, shale band from Witelskloof to Buffelshoek Peak, 1 200 m, Oct., *Esterhuysen 26352* (BOL).

4. *Schizodium obliquum* Lindl.

Petals with large anticus lobes; spur constricted at the base; lateral sepals 5–14 mm long.

Plants 55–290 mm tall, stem strongly flexuose, wiry, nitid, pale green to purple. Leaves basal and cauline; basal leaves petiolate, blade broadly obovate to

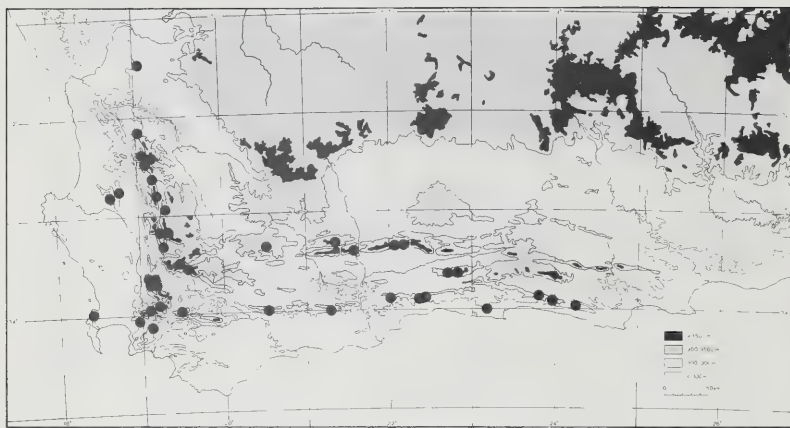


FIG. 5.
Distribution of *S. inflexum*.

spathulate, apiculate, 5–14 mm long and 3–9 mm wide; cauline leaves lanceolate, acuminate, 7–18 mm long, the upper $\frac{2}{3}$ free and distant from the scape. *Inflorescence* (2)–6–(9) flowered; bracts similar to the cauline leaves; pedicels 3–18 mm long, well exerted from the bracts, ovaries 2–10 mm long; flowers pale pink, lip with a dotted pattern. *Dorsal sepal* sub-erect, usually forming a 45° angle with the lateral sepals, lanceolate, sub-obtuse to sub-acuminate, 5–10 mm long and 1.5–4 mm wide; spur linear to clavate, 3–9 mm long, obtuse to slightly bifid, straight or somewhat bent up or down, dorsoventrally constricted at the base. *Lateral sepals* lanceolate obtuse to acuminate, usually acute, 5–14 mm long and 1.5–4 mm wide. *Petals* apex variously bifid, occasionally the anterior lobe much larger than the posterior lobe, basal anticus lobe large, the margins usually serrate, petals included in the galea. *Lip* pandurate; apical tooth terete, wedge-shaped to subulate, (1)–2–(5) mm long, darkly coloured; mesochile 1.5–5 mm wide, margins smooth or slightly crenate; hypochile concave, pale. *Column* short, anther reflexed, rostellum short, erect, stigma pulvinate.

TAXONOMIC NOTES

Lindley (1838) divided this group into three taxa. He differentiated them on petal, lip, sepal and spur shape. Lindley only had one specimen available for each of his taxa, and as a result most of the differentiating characters can now be shown to be variable, even within one population. Rolfe (1913) maintained Lindley's three species, but differentiated them on size (*S. obliquum*) and spur shape (*S. obtusatum* and *S. clavigerum*). This approach is more realistic.

A detailed analysis of 45 collections (including three population samples) showed that the material from the Cape Peninsula, Cape Hangklip, the flats eastwards to Stellenbosch and northwards to Darling, can be separated from the remaining collections. The most obvious differentiating characters are flower size and plant size (Fig. 6), in which there is partial separation. On the Peninsula, the lateral sepals tend to be, relative to the dorsal sepal, longer than in the rest of the distribution area. Spur shape also shows less variation on the Peninsula than it does elsewhere. It is usually dorsoventrally flattened, narrowly cuneiform and straight. The only geographic area of overlap is at Stellenbosch. *Strey 530* contains elements that could be referred to both subspecies. *Farnham* (Sept. 1885, Stellenbosch) falls clearly in the variation range of the Peninsula subspecies.

Among the remaining collections there is some variation in the dorsal sepal/lateral sepal length ratios, and in spur shape. But both these characters do not relate simply to the distribution patterns, and do not appear to be related to each other. In general, populations from Sir Lowry's Pass eastwards tend to have slender to cuneate spurs, and populations inland of the Du Toits Kloof and Bainskloof mountains often have very clavate spurs (e.g. *Linder 1120*).

Although there might be a link between the spur morphotype and the habitat of the population, with the more clavate forms occurring in wet sandy flats and the slender spurred forms occurring on well-drained mountain slopes, there are as yet insufficient data to demonstrate this link.

4a. *Schizodium obliquum* Lindl. ssp. *obliquum*

Lateral sepals generally longer than 8.5 mm, about $\frac{1}{3}$ longer than the dorsal sepal; plants 100–150–250 mm tall; from the Cape Peninsula and the Cape Flats to Darling.

NOMENCLATURE AND TYPIFICATION

Schizodium obliquum Lindl. in Gen. Sp. Orch.: 359 (1838). Type: Cape of Good Hope, *Forbes* (K!, holotype); Dur. and Schinz in Consp. Fl. Afr. 5: 114 (1892), excluding syn.; Kraenzl. in Orch. Gen. Sp. 1: 728 (1900); Rolfe in Fl. Cap. 5.3: 256 (1913).

Disa obliqua (Lindl.) H. Bol. in Trans. S. Afr. phil. Soc. 5: 162 (1888); in J. Linn. Soc. 25: 201 (1889), excl. syn.

Icones: H. Bolus, Icones Orch. Austro-Afr. 2. t.96 (1911). Kidd, Wild Flowers of the Cape Peninsula, Pl. 49.1 (1950).

Lindley (1838) described three species, here considered as synonyms (*S. obtusatum*, *S. obliquum* and *S. clavigerum*), in the same publication. All three names are valid, and none have priority. As *S. obliquum* has been used most often, this name is upheld here.

Schlechter (1901) ignored the name *S. obliquum*, and included the other synonyms and specimens referable to this species in his *S. bifidum*. Bolus (1911) followed this treatment.

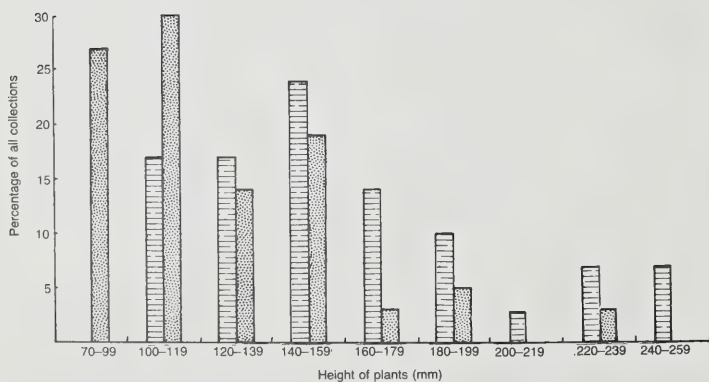
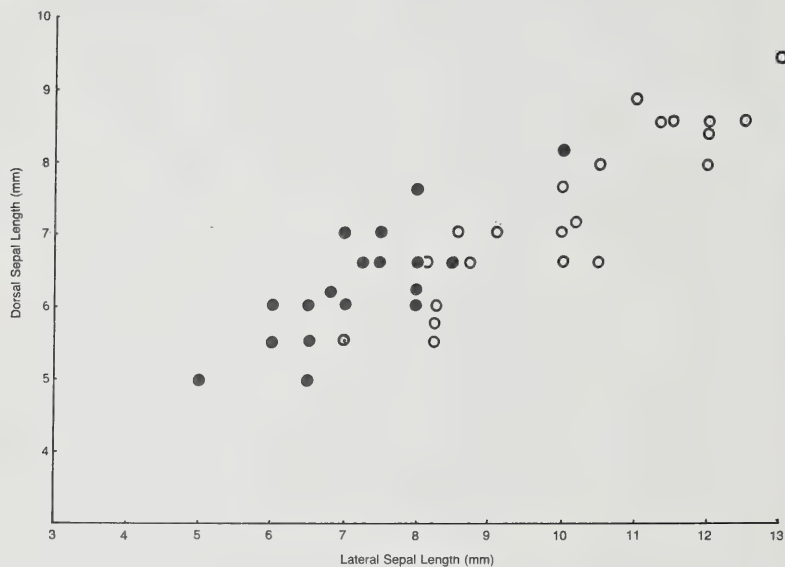
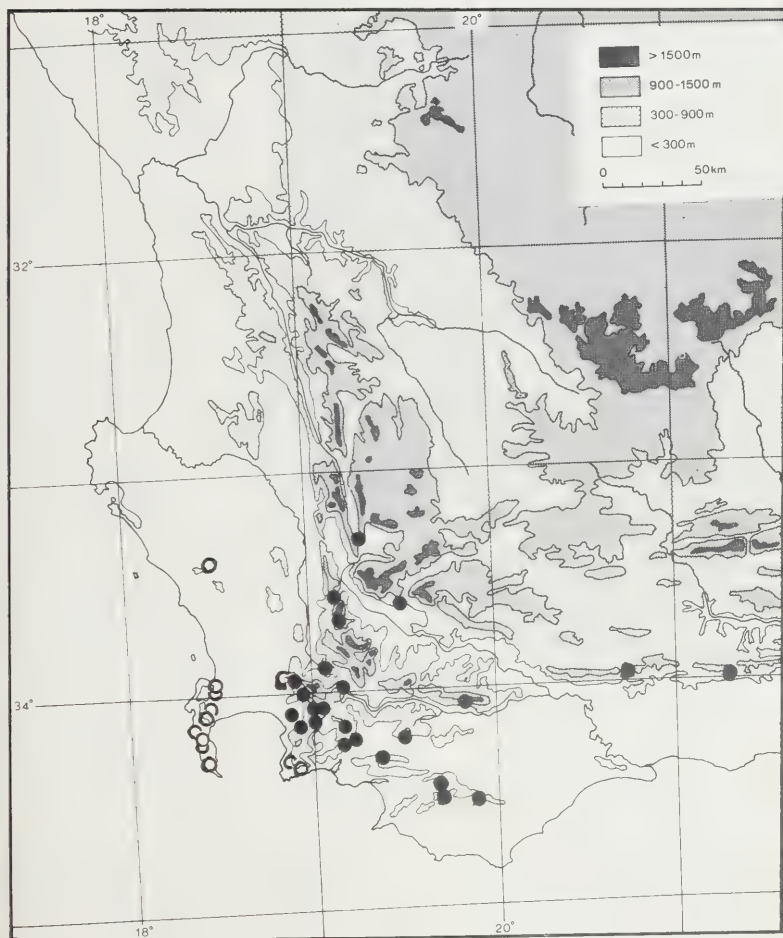


FIG. 6.

Variation in *S. obliquum*. The solid circles and right-hand (dotted) columns represent *ssp. clavigerum*, and the open circles and left-hand (horizontally barred) columns represent *ssp. obliquum*.



G.P.-5 (4).

FIG. 7.

Distribution of *S. obliquum*. Open circles represent the ssp. *obliquum* and solid circles represent the ssp. *clavigerum*.

ECOLOGY AND DISTRIBUTION

This subspecies occurs in the Cape Peninsula, with outlier populations at Darling and at Stellenbosch.

Populations studied all occurred on deep sand, rarely in the vicinity of rock outcrops. The sand may be of Recent origin or derived from Table Mountain Sandstone. In general the sand is damp in winter and spring, in the Darling population it is seasonally wet, with scattered subpopulations occurring on the margins of seasonal pools. Precipitation in the area ranges from near 500 mm p.a. at Darling to over 1 000 mm p.a. at Claremont, Cape Peninsula (W.B. 29). Rainfall occurs predominantly in the winter.

Flowering occurs mainly in August and September, occasionally in July and October. The altitude range of the species is from sea-level to c. 300 m.

REPRESENTATIVE COLLECTIONS

Cape Peninsula, Muizenberg mountain, 300 m, July, *Bolus 7037* (BOL); Malmesbury, Mamre Rd., Riverlands, August, *Linder 1125* (BOL, K, PRE).

4b. *Schizodium obliquum* Lindl. subsp. *clavigerum* (Lindl.) Linder

Lateral sepals generally shorter than 8.5 mm, about as long as the dorsal sepal; plants 80–120–240 mm tall, from the Western Cape excluding the Cape Peninsula and the Flats stretching to Darling.

NOMENCLATURE AND TYPIFICATION

Schizodium obliquum Lindl. ssp. *clavigerum* (Lindl.) Linder, stat. nov. et comb. nov.; basionym: *Schizodium clavigerum* Lindl. in Gen. Sp. Orch.: 360 (1838). Type: Western Cape, between Paarl and Groenekloof, *Drège 1231d* (K!, holotype; P!, S!); Dur. & Schinz in Consp. Fl. Afr. 5: 113 (1892); Kraenzl. in Orch. Gen. Sp. 1: 727 (1900); Rolfe in Fl. Cap. 5.3: 257 (1913).

Disa clavigera (Lindl.) H. Bol. in Trans. S. Afr. phil. Soc. 5: 163 (1888); in J. Linn. Soc. 25: 201 (1889).

Schizodium obtusatum Lindl. in Gen. Sp. Orch.: 359 (1838). Type: Paarl, Du Toits Kloof, *Drège 1231cc* (K!, holotype; G!, P!); Kraenzl. in Orch. Gen. Sp. 1: 729 (1900); Rolfe in Fl. Cap. 5.3: 256 (1913).

Schizodium gueinzii Reichb. f. in Linnaea 20: 694 (1847). Type: *Gueinziius s.n.* (W!, iconotype); Dur. & Schinz in Consp. Fl. Afr. 5: 113 (1892); Kraenzl. in Orch. Gen. Sp. 1: 730 (1900).

Disa gueinzii (Reichb. f.) H. Bol. in J. Linn. Soc. 25: 201 (1889).

Schizodium bifidum (Thunb.) Reichb. f. var. *clavigerum* (Lindl.) Schltr. in Bot. Jahrb. 31: 303 (1901).

Schizodium modestum L. Bol. in Fl. Pl. S. Afr. 19 Pl. 752 (1939). Type: Stellenbosch, near Somerset West, *Prentice 13900* (BOL!, holotype).

Icon: Fl. Pl. S. Afr. 19, Pl. 752 (1939).

Of the two names available for this subspecies, *S. clavigerum* was selected because it had already been applied at the infraspecific level, and is also better known than *S. obtusatum*.

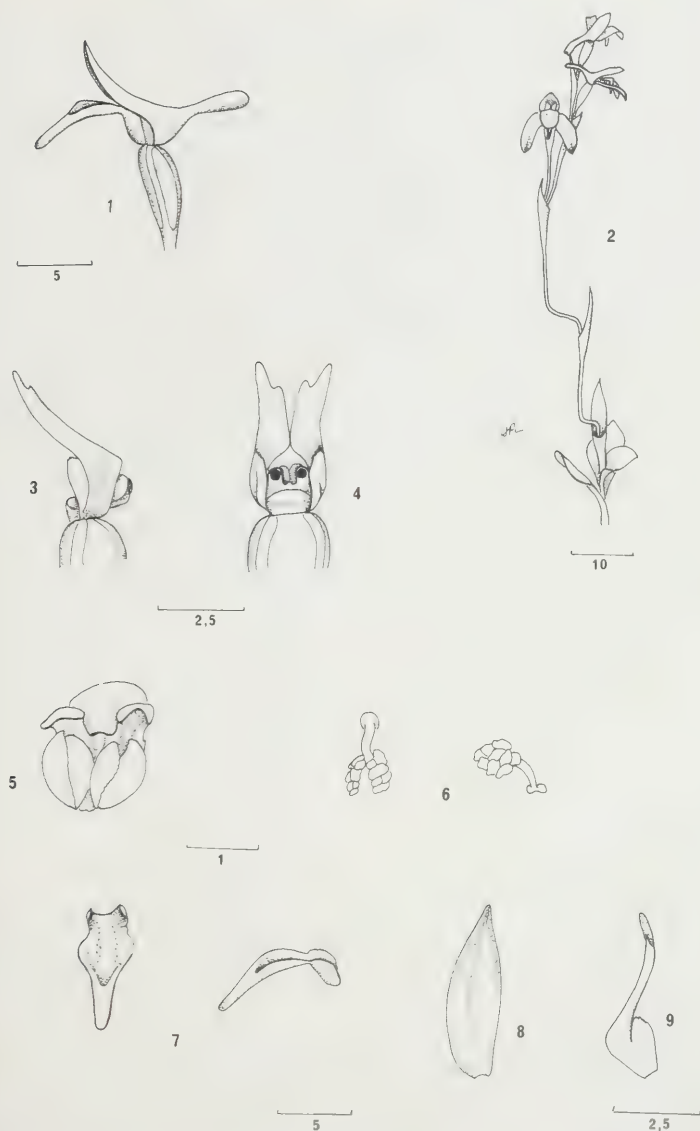


FIG. 8.

S. obliquum Lindl. ssp. *clavigerum* (Lindl.) Linder. From *Linder*. 1. Flower without lateral sepals. 2. Plant. 3 & 4. Petals & rostellum. 5. Rostellum rear view. 6. Pollinaria. 7. Lip in 3 dimensions. 8. Lateral sepal. 9. Lip.

No type specimen could be found for *S. guenzii*. In the Reichenbach herbarium in Vienna a drawing of the type exists; this is assumed to be an iconotype. The type locality of the species is unknown.

Schlechter (1901) included almost the whole of the species in *S. bifidum*, but separated out *S. clavigerum* at varietal level. He does not refer to *S. guenzii* at all. Kraenzlin (1900) includes *S. guenzii* under his "species dubiae".

S. modestum cannot be separated from the remainder of this subspecies, and the differential characters mentioned by Bolus are not valid.

ECOLOGY AND DISTRIBUTION

This subspecies extends from Bredasdorp in the east to Ceres in the west (Fig. 7), but does not occur on the Flats between the Cape Peninsula and Darling.

Habitat notes for collections from the eastern part of the distribution range all indicate stony sandy conditions on hills or mountain slopes, i.e. a well-drained habitat. Some of the records indicate that the area was burnt recently. Field studies on the population on the summit of Sir Lowry's Pass (*Linder* 577) supported these observations. The population was extensive, and occurred on well-drained Table Mountain Sandstone derived sand, with numerous stones in it. The area had been burnt some two years before that. The clavate form from Wolseley (*Linder* 1120) occurred in seasonally wet sand, in the valley floor. The population was subdivided into numerous subpopulations scattered along the margins of the seasonal ponds. There is, however, a lack of detailed habitat information about this species.

Rainfall over the distribution range varies from about 600 mm p.a. (over most of the range) to over 1 000 mm p.a. in the Jonkershoek to Paarl area. The rainfall is concentrated in the winter. This subspecies probably never experiences snow in the winter months.

Flowering occurs mostly in September, but specimens have been collected in flower from June to November.

REPRESENTATIVE COLLECTIONS

Tulbagh, Romansriver Railway Station, in seasonally wet sand, Aug., *Linder* 1120 (BOL, PRE); Caledon, Steenbras River, Oct., *Schlechter* 5386 (PRE).

5. *Schizodium cornutum* (L.) Schlechter

Lateral sepals usually longer than the dorsal sepal, recurved, acuminate, 12–18 mm long, with a wide base; dorsal sepal narrow acuminate.

Plant flexuose, wiry, nitid, 80–300 mm tall. *Leaves* basal and cauline; basal leaves petiolate, spatulate, apiculate, 6–16 mm long and 3–7 mm wide; cauline leaves 1–4, lanceolate, acute to acuminate, 6–18 mm long, the upper half free

and distant from the scape. *Inflorescence* 1–6 flowered; bracts like cauline sheaths; pedicels 4–15 mm long, mostly well exerted from the bracts, usually twice as long as the bracts, ovaries 3–10 mm long; flowers white to rarely rose-red, the lip pale green. *Dorsal sepal* linear, acuminate, recurved, convex, the basal part forming a hood over the petals, 7–12 mm long and 1.5–2 mm wide; spur 5–10 mm long, straight or slightly decurved, bifid. *Lateral sepals* linear-lanceolate, usually widest at the base, acuminate, recurved, 12–18 mm long. *Petals* 3–5 mm long, apex evenly to unevenly bifid, anticus lobe reduced to a fold. *Lip* tripartite, pandurate; apical tooth (2)–8–(13) mm long, subulate, pendant; mesochile margin often undulate; hypochile small. *Column* short, anther reflexed, rostellum short and broad.

NOMENCLATURE AND TYPIFICATION

Schizodium cornutum (L.) Schltr. in Ann. Trans. Mus. **10**: 248 (1924).

Satyrium cornutum L. in Pl. Rar. Afr.: 27 (1760). Type: Herb. Burman (G!, holotype).

Orchis biflora L. in Sp. Pl. ed. 3: 1330 (1764). Type: As for *Satyrium cornutum* L.

Schizodium biflorum (L.) Dur. & Schinz in Consp. Fl. Afr. **5**: 113 (1892); Kraenzl. in Orch. Gen. Sp. **1**: 725 (1900); Schltr. in Bot. Jahrb. **31**: 301 (1901).

Satyrium tortum Thunb. in Prod. Pl. Cap.: 5 (1794). Type: Thunb. herb. 21465 (UPS!, holotype).

Disa torta (Thunb.) Sw. in Kongl. Vet. Acad. Handl. **31**: 211 (1800); Thunb. in Fl. Cap.: 61 (1807); H. Bol. in Trans. S. Afr. phil. Soc. **5**: 161 (1883); in J. Linn. Soc. **25**: 201 (1889).

Schizodium arcuatum Lindl. in Gen. Sp. Orch.: 359 (1838). Type: Near Caledon, Drège 1231g (K!, holotype; G!); Rolfe in Fl. Cap. **5.3**: 257 (1913).

Orchis satyroides biflora bulbo indiviso, corolla galea unicalcarata, labello indiviso apice lanceolata L. in Amoen. Acad. **6**: 109 (1763).

Icon: H. Bolus, Icones Orch. Autro-Afr. **1**: t.33 (1893).

Satyrium cornutum L. was described from a specimen in the Burman herbarium, which is now in Geneva. The sheet of *S. cornutum* is in a bad condition, and the specimen not well pressed. However, the narrow reflexed lateral sepals and the long tooth of the lip indicate the taxon to which the name applies (see Figure 9).

In 1763 Linnaeus transferred *Satyrium cornutum* to the genus *Orchis*, but did not indicate a new specific epithet. He diagnosed the taxon merely as “*Orchis satyroides biflora*”, followed by the same diagnosis. This name has to be regarded as a polynomial. A year later he published the taxon under the name

Orchis biflora. This is therefore a later name for the epithet "*cornutum*". Thunberg did not seem to be aware of the correct nature of the Linnaean *Satyrium cornutum*, when he published his *Satyrium tortum*. Lindley, in turn, did not refer to either the Linnaean nor the Thunberg names. The confusion was resolved by Durand and Schinz (1892) and they were unaware of the earlier *Satyrium cornutum* of Linnaeus, and called the taxon *S. biflorum*. Schlechter (1924) finally made the correct combination for the species.

DISTRIBUTION AND ECOLOGY

The distribution of this species is indicated in Figure 11. This falls in the Western Group of Weimarck (1941).

Most of the localities are found below 900 m, although on the drier edges of the distribution range some populations occur at 1500 m. Populations usually

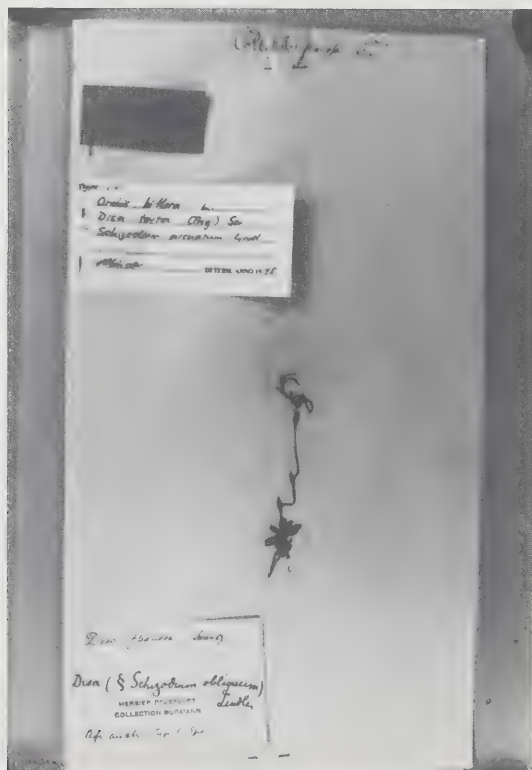


FIG. 9.1.

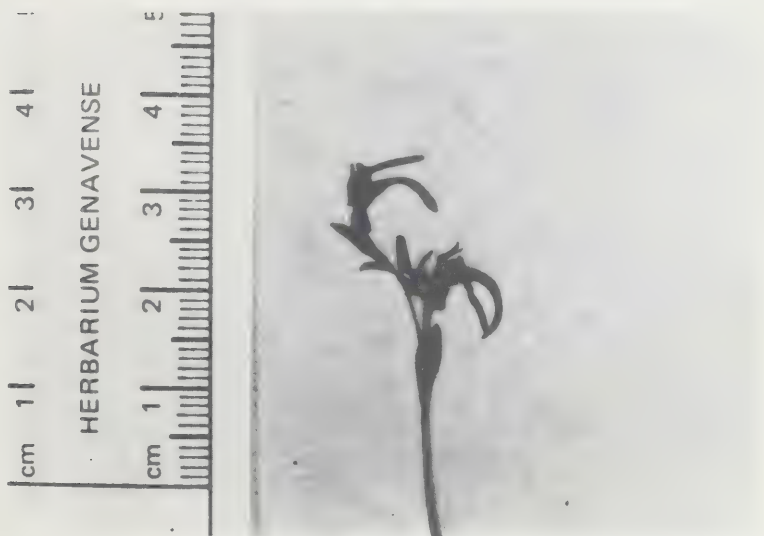


FIG. 9.2.

Holotype of *S. cornutum* (G). 1. The whole sheet. 2. Inflorescence.

occur in alluvial or flat sandy areas, usually on sand derived from Table Mountain Sandstone. Rainfall over the distribution range varies from about 400 mm p.a. at Nieuwoudtville to over 700 mm p.a. at Stellenbosch (W.B. 29), and of this about 70 % falls between May and September (inclusive) (W.B. 35). Flowering occurs between August and September, with occasional collections from as early as July, and some higher altitude collections from as late as October.

REPRESENTATIVE COLLECTIONS

Calvinia, 3 miles west of Nieuwoudtville, Aug., *Lewis* 2337 (SAM); Ceres, Gydouw Pass, Aug. 1939, *Leipoldt* (BOL); Clanwilliam, Olifants River, 35 Aug. 1894, *Schlechter* 5012 (BOL).

6. *Schizodium longipetalum* Lindl.

Anterior petal lobes at least as long as the limb of the petal, filiform, reflexed, similar to the tooth of the lip; leaves crisped, undulate.

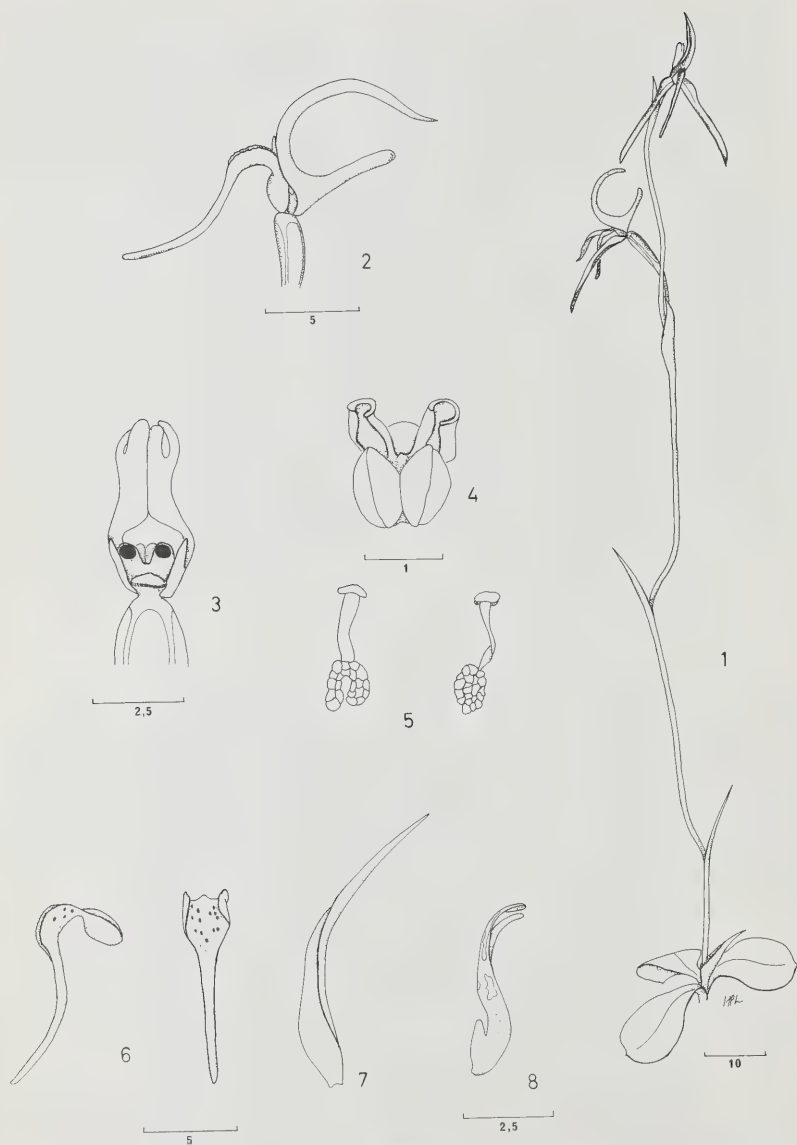
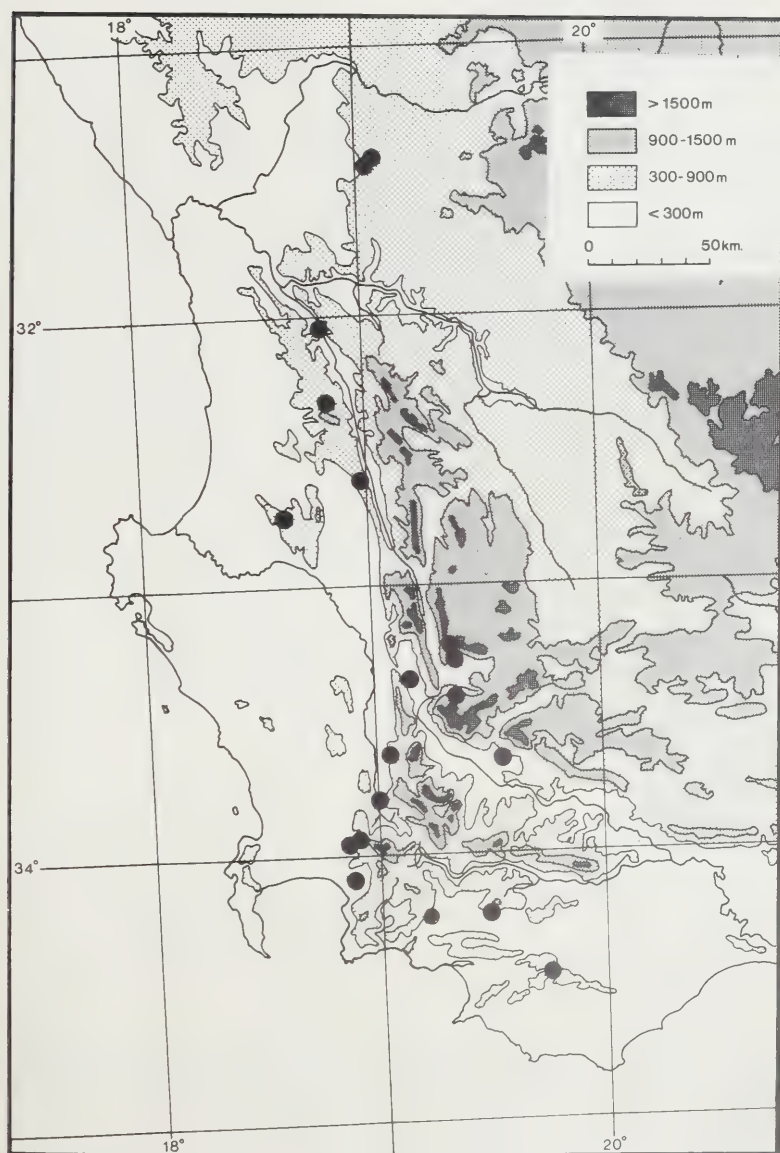


FIG. 10.

S. cornutum (from Linder). 1. Whole plant, 2. Flower with the lateral sepals removed, 3. Front view of petals and column, 4. Rear view of rostellum, 5. Pollinaria, 6. Lip in 3 dimensions, 7. Lateral sepal, 8. Petal.



G.P.-S. (L).

FIG. 11.
Distribution of *S. cornutum*.

Plant 7–20 mm tall, scape wiry, flexuose. *Leaves* basal and cauline; basal leaves petiolate, spatulate, lorate, apiculate, 8–12 mm long and 3–6 mm wide, margins crisped-undulate; cauline leaves 2–3, oblong lanceolate, acute to acuminate, 8–13 mm long, the upper half free. *Inflorescence* (2)–6–(7) flowered; bracts similar to the cauline leaves; pedicels 3–10 mm long and ovaries 3–5 mm long; flowers greenish-yellow, lip mesochile and base of the lateral sepals with purplish spots, filiform processes of the petals and lip dull purple. *Dorsal sepal* recurved, lanceolate, acute to very acuminate, 7–12 mm long and 2–3 mm wide; spur 2–3 mm long, bluntly bifid, straight to slightly decurved, constricted at the base. *Lateral sepals* narrowly lanceolate, acuminate to very acuminate, recurved, 8–12 mm long and 1.5–2 mm wide. *Petals* bent near the base, zygomorphic, 2–3 mm long, basal anticus lobe absent, apex unequally bifid with the anterior tooth filiform, reflexed, at least twice as long as the petal limb, the posterior tooth very small or absent. *Lip* pandurate, the hypochile and the epichile sub-equal, 1.3–3 mm wide, the apical tooth subulate, 3.5–9–12 mm long, often reflexed. *Column* short, anthers reflexed, rostellum tridentate, stigma pulvinate.

NOMENCLATURE AND TYPIFICATION

Schizodium longipetalum Lindl. in Gen. Sp. Orch.: 359 (1838). Type: Paarl, Paarlberg between 1 000 and 2 000 feet, *Drège* 8273 (K!, holotype; P!, S!); Dur. & Schinz in Consp. Fl. Afr. 5: 115 (1892); Kraenzl. in Orch. Gen. Sp. 1: 725 (1900); Rolfe in Fl. Cap. 5.3: 258 (1913).

Disa longipetala (Lindl.) H. Bol. in J. Linn. Soc. 25: 201 (1889).

Schizodium antenniferum Schltr. in Bot. Jahrb. 24: 426 (1898). Type: Piketberg, *Schlechter* 5248 (B, holotype; BOL!, PRE!, SAM!, Z!); Schltr. in Bot. Jahrb. 31: 305 (1901).

Schizodium bifidum sensu Schlechter, partly, non Reichb. f., in Bot. Jahrb. 31: 303 (1901).

Icon: H. Bolus, Icones Orch. Austro-Afr. 1: t.88 (1896).

This quite distinct species is clearly described and typified. However, the material from the Piketberg, on which Schlechter based his *S. antenniferum*, is somewhat different, though not enough to warrant specific distinction. Schlechter (1901) also included Lindley's *S. longipetalum* in his large variable *S. bifidum*. The illustration in Bolus (1896) was probably done from the type collection of *S. antenniferum*.

TAXONOMY, DISTRIBUTION AND ECOLOGY

S. longipetalum is only known from four localities, two of which might be extinct. It appears as if the species is restricted to proteoid shrubland on gravelly soils derived from Table Mountain Sandstone, in a rainfall regime of c. 700 mm p.a., of which most falls in winter (W.B. 35). Populations appear to be scattered, and are difficult to find in the dense vegetation.

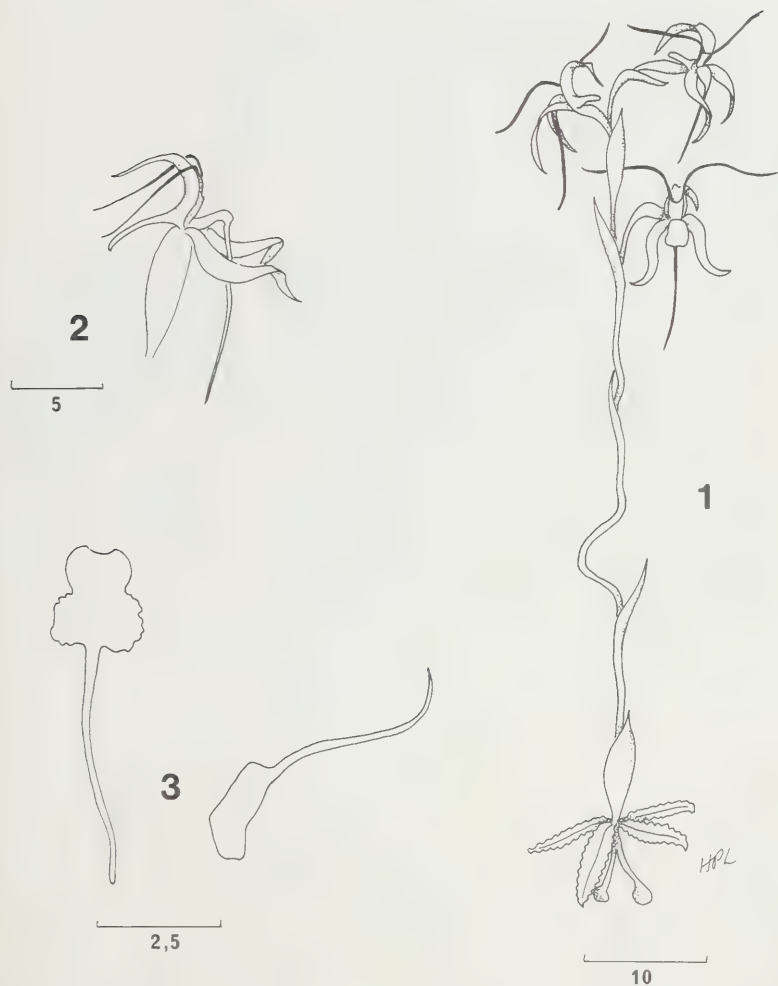
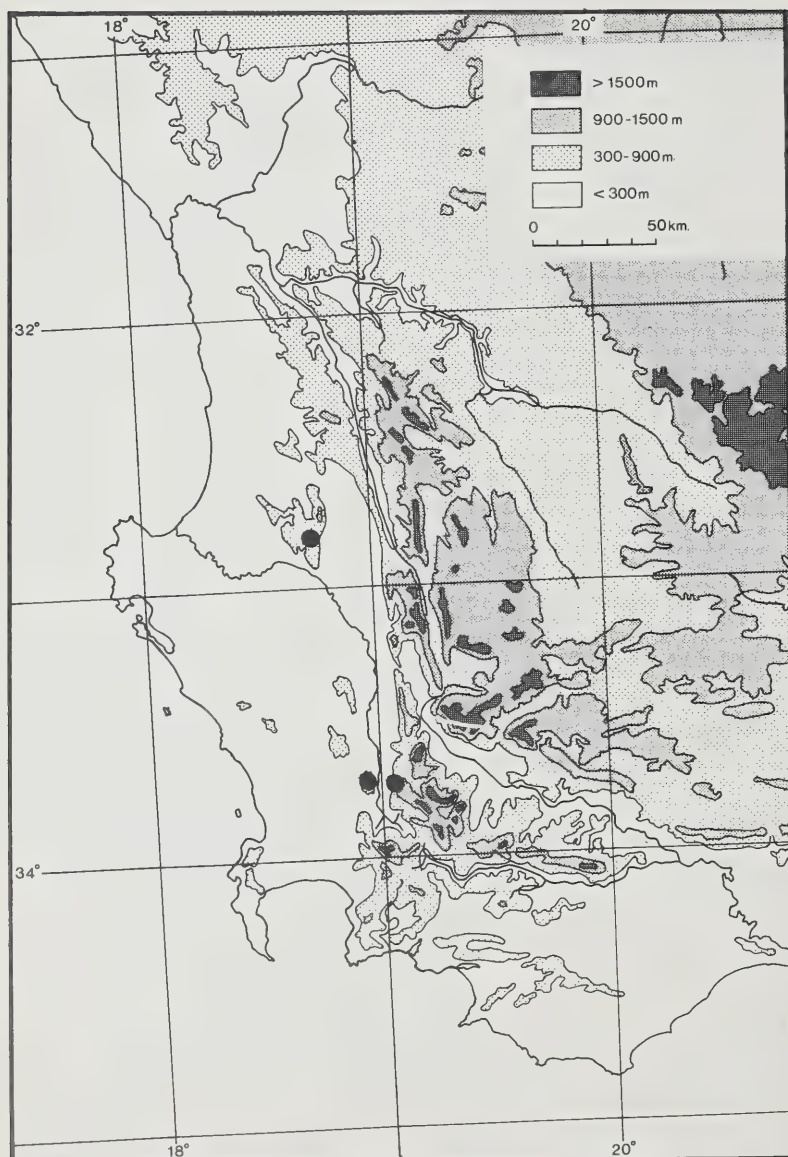


FIG. 12.

S. longipetalum (adapted from Bolus 1896). 1. Whole plant, 2. Detail of flower, 3. Petal and lip in 2 dimensions.



G.P.-S. (L).

FIG. 13.
Distribution of *S. longipetalum*.

The material from the Worcester and Paarl areas is fairly uniform, and falls well within the concept of *S. longipetalum*. However, the material known from the Piketberg has longer anterior petal lobes and a longer lip tooth. On this material Schlechter based his *S. antenniferum*. The population is also isolated from the rest of the species, and could be regarded as a geographical form of that species. However, not enough information is available about the Piketberg population which last flowered in 1971, and it is at this stage best included in *S. longipetalum*.

REPRESENTATIVE COLLECTIONS

Paarl District, 5 m south of Huguenot, Aug., *Salter 4732* (BOL).

SPECIES EXCLUDED

Schizodium maculatum (L.f.) Lindl. in Gen. Sp. Orch.: 360 (1838).

This is *Disa maculata* L.f., as in H. Bol. in J. Linn. Soc. 20: 478 (1884).

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Names not recognised are printed in italics.

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APPENDIX 1. LIST OF SPECIMENS STUDIED.

The specimens are listed alphabetically according to the name of the collector. The figures in brackets refer to the number of the taxon in the text. Herbaria from which each collection has been studied are indicated by the letter codes of Holmgren and Keuken (1974).

Ackerman in STE 17026 (4b) STE—Acocks 1946 (2) S; 2170 (1) S; 2406 (4b) S; 2436 (2) S; 2451 (2) S; 2512 (5) S; 15509 (1) PRE. K; 19724 (5) PRE; 21409 (2) PRE; 22489 (2) PRE; 23737 (2) PRE; 24038 (2) PRE—Adamson in SAM 39048 (1) SAM—Alexander (4a) PRE—Anderson in STE 29988 (1) PRE. STE—Andrag in STE 8569 (2) STE—Andreae 672 (3) PRE, STE; 1208 (3) PRE; 1304 (3) BOL, STE.

Bachman 1632 (5) Z; 1633 (1) Z; 1972 (5) Z—Baker 264 (4b) NBG, SAM—Barker 3096 (1) NBG; 3109 (2) NBG; 3122 (1) NBG; 3127 (3) NBG; 3809 (4b) SAM; 4129 (1) NBG; 4786 (5) NBG; 7495 (2) NBG; 10634 (2) NBG—Barnard in SAM 28947 (3) SAM—Basson (5) STE—Bodkin 7019 (2) BOL, K; (3) BOL—Bolus 3550 (3) BOL; 3742 (4a) BOL, K. PRE; 3882 (3) BM, BR, K. Z; 4332 (1) BM, BOL, K, Z; 5444 (5) K; 5445 (5) BOL, K; 5446 (4b) BOL; 5923 (4b) BOL; 7037 (4a) BOL; 7481 (2) BOL; 7514 (4b) BOL; 11647 (3) BR, BOL; 13900 (4b) BOL; 19579 (5) BOL; 19580 (3) BOL; 23369 (3) BOL; (2) BOL; (3) BOL; (3) BOL; (4b) BOL—Bond 580 (3) NBG; 639 (3) NBG; 649 (1) NBG—Booyesen 67 (3) NBG—Boucher 429 (4b) STE; 1370 (4a) STE; 2879 (1) STE—Bowie 6 (4b) BM; 412 (4a) G—Brenan 14032a (3) K—Burbury 272 (4a) BM—Burchell 655 (3) K; 7107 (3) K.

Commerson (1) G—Compton 3383 (2) BOL; 4148 (1) BOL; 5677 (4b) NBG, SAM; 10080 (3) NBG; 11948 (2) NBG; 11979 (2) NBG; 13293 (4a) NBG, SAM; 13473 (4b) NBG, SAM; 13482 (4b) NBG, SAM; 13828 (4b) NBG, SAM; 13994 (3) NBG; 15743 (4a) NBG, SAM; 18334 (1) NBG; 18798 (3) NBG; 19919 (2) NBG; 20115 (2) NBG; 20179 (4a) NBG, SAM; 20999 (2) NBG; 21813 (3) NBG—Cummings 4 (2) GRA; 263 (2) GRA; (5) BOL.

Davis in SAM 49376 (3) SAM—Davis & Stokoe in SAM 22018 (4b) SAM; in SAM 61031 (4b) PRE; in SAM 61036 (1) PRE, SAM—De Villiers in STE 8557 (1) STE; (5) STE—Drège 56 (2) GRA, PRE, SAM; (2) BOL. Z—Drège 1231a (3) P; 1231b (5) G, K, P; 1231c (4b) K, P; 1231cc (3) P; 1231f (3) P; 1231g (5) P; 1238 (1) G, K, P, S—Duemmer 553a (3) BM—Du Plessis (1) STE.

Ebersohn 269 (4b) NBG, SAM—Ecklon 321 (1) Z—Ecklon & Zeyher 63 (1) SAM; 64 (5) K, PRE, Z; (3) S—Edwards in BOL 13901 (5) BOL, Z; (4b) G—Esterhuysen 3117 (3) BOL, PRE; 3119 (3) BOL; 3180 (2) BOL; 6443 (3) BOL; 6793 (3) BOL, PRE; 8209 (2) BOL; 9250 (3) BOL; 9445 (3) BOL; 10633 (3) BOL; 12151 (3) BOL, PRE; 13981 (2) BOL; 14077 (2) BOL; 15912 (2) BOL, PRE; 16388 (3) BOL, PRE; 17444 (1) BOL, M; 20355 (5) BOL; 20357 (2) BOL; 20804 (3) BOL; 23170 (2) BOL; 24003 (3) BOL; 29618 (4b) BOL; 31190 (4a) BOL; 33594 (4b) BOL; 34362 (4b) BOL.

Farnham in Bolus 5922 (5) BOL, K, PRE; in Bolus 5923 (4b) BOL, K, SAM; in MacOwan & Bolus 1376 (5) BM, BOL, G, K, P, PRE, SAM, UPS, ZT; in SAM 22018 (4b) SAM; (4a) BOL—Flugge-de Smidt (1) NBG—Fourcade 532 (3) GRA; 2826 (3) K, STE; (3) STE—Fries, Norlindh & Weimarck 281 (2) K—Froemling 567 (3) SAM—Fry in Herb. Galpin 4991 (2) PRE.

Galpin 3004 (2) PRE; 4625 (4b) PRE; 4626 (3) BOL, GRA, K, PRE; 4627 (3) PRE; 4991 (2) PRE—Garabedian in SAM 51404 (2) SAM; (1) K—Garside 49 (4b) K—Gillett 123 (2) BOL; 164 (2) BOL; 239 (2) BOL; 858 (4b) BOL; 1346 (3) BOL; 1790 (4b) BOL—

Goldblatt 420 (4b) BOL—Grant 2318 (2) PRE; 2330 (6) BOL, M, PRE; 2447 (1) K; 2448 (5) BR, PRE—Grey (1) K—Guthrie 1074 (1) NBG; 2460 (4b) NBG, SAM; 2461 (2) NBG; 2462 (2) BOL, NBG; 2463 (4b) NBG, SAM; (1) NBG—Guthrie & Page (2) PRE. Häfstrom & Acocks 369 (1) S; 370 (2) S—Häfstrom & Lindeberg (3) S—Hall 1044 (1) BOL; 1051 (5) BOL; 1193 (3) BOL—Hallack in Herb. Galpin 3004 (2) K, PRE—Haneekom 708 (1) K, PRE; 709 (2) K, PRE, STE—Harvey (4a) K—Haynes 394 (4b) STE; 471 (3) STE—Haynes-Palmer in CH 57629 (2) NBG—Henderson 11979 (2) BOL; in CH 57619 (1) NBG—Henrici 3818 (1) PRE—Hesse 10 (4b) BOL, K—Holland (2) K—Hutchinson 584 (4b) BOL, K; 798 (3) K; 1014 (3) K; 1210 (3) K.

Immelman 256 (1) BOL.

Jeppe in PRE 33430 (2) PRE; (3) PRE.

Kassner 1219 (1) P; 1481 (1) P—Keet (5) STE—Kerfoot 5373 (4b) BOL; 5889 (2) NBG; 5962 (3) NBG—Kies in CH 57631 (3) NBG—Knobel in PRE 22923 (2) PRE—Kruger 546 (3) STE; 1080 (4b) STE.

Leighton 2159 (3) BOL; 2292 (3) BOL; 3024 (2) BOL—Leipoldt 909 (3) BOL, NBG; 928 (1) BOL; 3204 (5) BOL; 3808 (1) BOL; 4074 (5) BOL; (3) BOL; (4b) BOL; (5) BOL; (5) BOL—Lewis 107 (4a) SAM; 708 (3) SAM; 723 (4a) SAM; 872 (3) SAM; 1649 (4b) SAM; 1831 (4a) SAM; 2336 (4b) SAM; 2337 (5) SAM; 2678 (2) SAM; 2679 (1) SAM; 3555 (4b) SAM; 4751 (1) SAM; 5642 (3) NBG; 5717 (5) NBG; 5871 (5) NBG; 6053 (1) NBG; 22272 (3) BOL; (1) BOL; (1) BOL; (2) BOL; (3) BOL—Liebenberg (5) STE—Linder 471 (3) BOL; 472 (3) BOL; 574 (3) BOL; 575 (2) BOL; 576 (2) BOL; 577 (4b) BOL; 578 (3) BOL—Linley in SAM 49373 (4b) SAM; Linley in SAM 49375 (2) PRE, SAM; in SAM 56095 (1) SAM; in SAM 56522 (4a) PRE, SAM; in SAM 59666 (3) SAM—Long 1405 (2) BOL.

MacOwan 172 (1) BOL, SAM; in STE 13004 (4b) STE; (4a) GRA—MacOwan & Bolus 172 (1) BM, G, GRA, K, UPS, ZT; 173 (4a) BM, BOL, G, K, SAM, UPS, ZT; 1375 (3) BM, G, K, P, PRE, SAM, ZT; 1376 (5) BM, BOL, G, K, P, PRE, SAM, UPS, ZT—Maguire 173 (5) NBG—Mann 11371 (2) PRE—Marais (1) STE—Markotter (2) STE—Marloth 1825 (3) PRE; 1894 (3) PRE; 7034 (4b) PRE; 7036 (2) PRE; 7104 (5) PRE; 7105 (1) PRE; 10566 (2) PRE; 10621 (1) PRE; 10673 (3) PRE—Marsh 552 (2) STE—Middlemost 2211 (2) STE—Morrison (1) STE—Muir 675 (2) PRE; 803 (3) BOL, PRE, SAM; (3) BOL—Mund (3) G, GRA.

Oliver 1341 (2) STE; 3031 (3) STE; 3498 (2) PRE; 4023 (1) K, PRE, STE; 4031 (1) PRE, STE; 5083 (3) K, STE; 5084 (1) STE; 5166 (1) STE.

Pappe in SAM 22013 (1) K, P, SAM; in SAM 22020 (4b) SAM; (4a) SAM—Paterson 1142 (2) BOL; in PRE 25796 (2) PRE—Penther 192 (5) PRE; 256 (5) BM—Phillips 1859 (3) SAM; 7561 (1) BOL, K, PRE, SAM, STE—Phillipson 1405 (3) K—Pillans 7303 (3) BOL; 7835 (2) BOL—Pocock 160 (3) PRE, STE—Pole-Evans 4267 (3) PRE—Powrie 167 (3) BOL—Prentice in Bolus 13900 (4b) BOL; in Marloth 7034 (4b) PRE—Primos 102 (3) PRE.

Rehman 29 (3) BM, Z; 569 (4a) Z; 2223 (5) Z; 5854 (3) Z—Ringgold & Rogers 132 (4a) K—Roberts (4b) PRE—Roberts & Adendorff in PRE 17623 (4b) PRE; (1) PRE—Rogers 3038 (2) G; 16590 (2) G; 17876 (3) Z—Roxburgh (1) BM—Rycroft 2556 (1) M, NBG.

Salter 1290 (2) BM; 4681 (5) BM, BOL, K; 4724 (2) BM, BOL, K; 4732 (6) BM, BOL, K; 4741 (4b) BOL; 4742 (4b) BM; 6215 (4b) BOL; 6281 (4a) BOL; 8471 (4a) BOL; 325/11 (4a) BM, K; in SAM 53007 (4a) SAM—Sanderson 929 (5) K; 930 (2) K—Schelpe 4142 (5) BM; 4885 (4b) BOL; 7116 (3) BOL—Schlechter 123 (3) BM, GRA, P, PRE, Z; 171 (3) Z; 1144 (4b) BM, G, GRA, K, M, PRE, SAM, Z; 1175 (2) BM, BOL, G, GRA, K, M, W, Z; 1314 (4a) BM, G, GRA, K, Z; 1375 (3) SAM; 1433 (4b) BM, BR, GRA, K, Z; 1463 (4a) Z; 1551 (4a) Z; 1661 (1) GRA, Z; 5012 (5) BOL, GRA, Z; 5103 (5) BM, BOL, BR, G, GRA, K, P, PRE, STE, UPS, Z; 5248 (6) BM, BOL, BR, PRE, S, SAM; 5386 (4b) BM, G, GRA, K, PRE, Z; 5414 (3) Z; 5488 (3) BM, G, GRA, K, PRE, Z; 7894 (5) BM, G, GRA, K, P, PRE, Z; (3) PRE—Schroeter (1) ZT—Scully (1) SAM; (4b) BOL, Z—Seligman (3) BM—Sidey 1857 (1) PRE, S; 2296 (4a) S—Sieber (1) P—Skinner 2

(3) GRA—Smith 24 (4b) STE—Stauffer & Oliver 5091 (4b) G, K, Z: 5108 (4a) Z—Steyn 356 (2) NBG: 656 (4a) SAM—Stokoe 1109 (3) PRE: 8924 (4b) BOL: 10566a (3) PRE; in Marloth 10566 (2) PRE; in SAM 49374 (4b) SAM; in SAM 49375 (4b) SAM; in SAM 49377 (3) SAM; in SAM 55876 (3) SAM; in SAM 56872 (4b) SAM; in SAM 57987 (4b) SAM; in SAM 57988 (4b) SAM; in SAM 59665 (4b) SAM; in SAM 60133 (5) SAM; in SAM 60399 (4b) SAM; in SAM 61030 (4b) SAM; in SAM 61032 (3); in SAM 61035 (5) SAM; in SAM 63144 (3) SAM; in SAM 63772 (2) SAM; in SAM 68582 (2) SAM; (2) BOL: (3) STE—Strauss 45 (3) NBG: 49 (3) NBG: 54 (1) NBG, Strey 530 (4b) PRE: 589 (1) PRE; 831 (2) PRE—Swart in STE 11153 (4b) STE.

Taylor 243 (3) BOL: 982 (3) SAM: 1003 (3) SAM: 4945 (4b) STE: 5824 (4b) STE—Thode 1027 (3) K, PRE: 2073 (3) PRE: 2594 (2) PRE: 5425 (4a) STE: 8162 (4a) STE—Thomas in CH 62762 (1) NBG—Thorne in SAM 38964 (3) SAM; in SAM 46510 (3) SAM—Thunberg 21466 (3) UPS—Thurling & Neil (5) PRE—Trimen (1) BM; (2) BM—Tyson 642a (4b) GRA; 642b (3) GRA; 642c (6) GRA; 642 (1) BOL, SAM.

Van der Merwe 992 (5) PRE—Van Niekerk 305 (4b) NBG, SAM: 306 (2) NBG: 632 (5) BOL—Van Staden 11 (3) PRE—Verdougq 26 (4b) STE—Verreaux (1) G—Viljoen in STE 11515 (4b) STE.

Wahlberg (3) S—Walgate 401 (1) NBG—Wall (1) S; (3) S; (5) S; (4a) S—Wasserfall 373 (2) NBG: 373a (2) NBG: 515 (3) NBG: 603 (3) NBG—Werdermann & Oberdieck 896 (3) PRE: 986 (3) PRE: 8646 (3) PRE—West (2) GRA—Wilms 3662 (4a) BM, K, P—Wolley-Dodd 496 (1) K: 606 (4a) BM, BOL, K: 1291 (4a) BM; 1489 (4a) BOL: 1896 (4a) K: 2125 (3) BM, BOL, K: 2746 (4a) BOL, K; in SAM 51403 (2) SAM—Worsdell (1) K; (4b) K—Wurts 1068 (2) NBG; 1069 (3) NBG; 1429 (2) NBG.

Zeyher 372 (4a) K; 419 (1) P; 1571 (4a) BOL, G, K, P, PRE, S, Z; 3927 (1) BM, PRE: 3928 (5) BM, K, P, PRE, S, SAM, Z: 3929 (2) BM, K, S, W: 3930 (4b) BM, K, P, SAM; in SAM 22007 (1) K, SAM; in SAM 22015 (3) K, SAM; (4a) SAM.